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### Comparing reconstruction techniques for proximal tibia tumors: Allograft prosthetic composites are associated with higher reoperation rate but longer survival than proximal tibia replacements

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**Background:** The proximal tibia is a common location for primary bone sarcomas, giant-cell tumors, and metastatic disease. Historically, proximal tibia tumors were treated with amputation due to the complex popliteal neurovascular anatomy; however, recent advances in surgical techniques have increasingly shifted treatment towards limb salvage. Two proximal tibia reconstruction techniques are placement of a proximal tibial replacement (PTR) prosthesis or allograft-prosthesis composite (APC). While PTR reconstruction allows for early weightbearing, APC reconstruction allows for anatomic soft tissue reconstruction to the allograft as needed. Each method has been individually reviewed in prior work; however, there is a paucity of data comparing the two techniques in the setting of reconstruction following tumor excision.

**Study Purpose:** This study aims to compare the oncologic and functional outcomes of PTR vs. APC reconstruction following proximal tibia tumor excision.

**Patients and Methods:** We retrospectively reviewed 39 (18 male, 21 female) patients with proximal tibial tumors who underwent tumor excision and either allograft-prosthesis composite reconstruction (n=20) or proximal tibial replacement (n=19) from 1988 to 2020. Mean tumor size was  $9.5 \pm 7$  cm. 31 tumors were malignant (24 primary bone tumors, 7 metastatic) and 8 were locally aggressive giant cell tumors. Eight (21%) patients underwent radiotherapy, and 25 (64%) underwent chemotherapy. 35 patients (90%) required soft tissue coverage with a flap (34 local, 1 free flap). Mean age was 39, mean BMI was  $25 \text{ mg/kg}^2$ , and mean follow up was 10 years.

**Results:** Patients undergoing APC reconstruction were significantly younger than the PTR group, with a mean age of 31.65 years vs. 47.5 years, respectively ( $p=0.02$ ). APC patients were significantly more likely to undergo reoperation, with 11 (55%) requiring reoperation compared to 4 (21%) in the PTR cohort (OR 4.6, 95% CI 1.12-18.8). Revision rates in both groups were low, with 4 APC revisions and 1 PTR revision, and no significant difference in revision risk between groups (OR 4.5, 95% CI 0.45-44.5). Only 3 patients (2 APC, 1 PTR) underwent amputation; the APC amputations were for non-union and infection, respectively, and the PTR amputation was for recurrent component dislocation. Overall, 10-year survival was significantly higher in the APC cohort at 70%, compared to 30% in the PTR group ( $p=0.03$ ). There was no difference in post-operatively knee extension between groups, with a mean  $4^\circ$  extension lag in the APC group and  $2.5^\circ$  lag in the PTR group ( $p=0.45$ ). Two APC patients and one PTR patient had a clinically significant extension lag  $>10^\circ$  postoperatively.

**Conclusions:** Patients undergoing APC reconstruction tend to be younger than those selected for PTR. APC patients are also at significantly increased risk for reoperation compared to PTR patients; however, 10-year overall survival was significantly higher in the APC group. Revision rates were low in both groups. In comparing functional outcomes, postoperative extensor lag was rarely clinically significant, with no statistical difference between groups. Overall, both limb-salvage methods have low revision rates and good functional outcomes.